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ANATOMICAL NOTES ON CERTAIN WEST AMERICAN HELICES.

BY H. A. PILSBRY AND E. G. VANATTA.¹

THE GENUS GLYPTOSTOMA.

This genus has very distinct conchological features, the shell recalling the typical *Zonites* in form. The jaw, radula and genitalia have been investigated and figured by W. G. Binney. From these data the senior writer placed *Glyptostoma* in the group *Belogona Euadenia* of the arrangement of Helices given in volume IX of the *Manual of Conchology*, near the genus *Epiphragmophora*. We have now examined two specimens of *G. Newberryanum*. The genital system of one is figured on Pl. I, fig. 1. The two examples dissected agree perfectly in all details, but in several points do not correspond with Binney's figures. The right eye is retracted between ♂ and ♀ branches of the genitalia. The penis is continued a short distance beyond the insertion of the vas deferens, and may be regarded as having a rudimentary epiphallus, the long retractor inserted thereon distally. There is no trace of a flagellum. Vagina long, at its apex the very long duct of the spermatheca enters. This duct is of the length of the uterus and terminates in a large globular spermatheca. No diverticulum. At the point where the sp. d. enters, an ovate sessile body is placed. This has the shining, fleshy muscular substance commonly seen in dart sacks; and we do not doubt that the organ is of that nature, although no dart was found in either of the two individuals dissected. The lumen presented several broad folds, and no distinct apical papilla. There is no trace of mucus glands. The talon is unusually long.

From these characters it appears that the genus, while probably belonging with the series of American dart-bearing Helices, is extremely isolated. The other American genera, *Epiphragmoph-*

¹ The dissections and drawings of all species noticed in this paper are by Mr. Vanatta, who is also responsible for all anatomical details of the several forms. The more general discussions relating to the systematic bearings of the facts developed are by Mr. Pilsbry.

We would here acknowledge our indebtedness to Professor W. H. Dall for alcoholic specimens of several of the forms discussed below.

ora, *Lysinoe*, *Leptarionta*, *Cepolis*, and *Polymita* are all more nearly allied to each other than to *Glyptostoma*.²

The lack of mucus glands is a degenerative feature unique in *Belogona Euadenia*, though it occurs in the *Belogona Siphonadenia*.

The high insertion of the dart sack is very unusual.

The talon is longer than in any other *Helix* known to us.

The loss of a flagellum on the penis is unique among American *Euadeniæ*, but occurs in certain Chinese forms of *Eulota* and in many other Old World groups. It is not usually a character of generic importance in Helices.

THE MICRARIONTA GROUP OF EPIPHRAGMOPHORA.

Micrarionta was proposed by Mr. C. F. Ancey as a subgenus of *Helix*, based mainly, it would seem, upon the small size of the shell and reflexed lip of its type, *H. facta*. In the "Guide to the Study of Helices" the group was expanded to include the larger, simple-lipped Lower Californian Helices which Binney (following von Martens) referred to *Euparypha*; and it was shown to have well marked anatomical features unlike any other known group of Helices.

The three subgeneric groups into which our West Coast Epiphragmophoras were divided in the "Guide,"—*Micrarionta*, *Helminthoglypta* and *Monadenia*,—differ trenchantly in the forms of their mucus glands. In the first they are inserted by two separate ducts at the base of, rather than upon, the dart sack. In the second a single duct enters the dart sack, and splits into two bulbiferous branches above. In the third there is a single club-shaped gland. The other characters of the soft anatomy, as well as the shells, are not very unlike in the three groups.

Of the eleven species of *Micrarionta*, *E. intercisa* and *E. levis* are unknown anatomically. *E. Gabbi*, *ruficincta*, *intercisa*, *Kelletti* and *Tryoni* are known to us by W. G. Binney's figures, but several characters being unnoticed by Binney, a reëxamination of these is desirable. We have dissected *E. areolata*, *Pandoræ*, *Veitchii*, *Stearnsiana* and *Guadalupiana*.

E. Guadalupiana Dall, Pl. I, fig. 11 (genitalia) differs considerably from the other species examined. The flagellum is but little

²*Leptarionta* is hardly sufficiently known to be included in this statement. It should be stated that the shell characters of *Glyptostoma* are also notably different from any of the other genera named.

longer than the penis and epiphallus taken together. The spermatheca duct bears no diverticulum. *The dart sack is degenerate*, reduced to a small wide bud, one mucus gland arising at its right side, descending, club-shaped, the other at left side, ascending and slightly sacculated; *both entirely free*, not bound to the vagina. *The right eye-retractor passes to the left of the genital system, not between its branches.*

The last characters may be expected to occur in *E. facta* and *ruficincta*. It is a very unusual feature. The subobsolete condition of the dart sack is unlike any allied species. The measurements are: length of penis+epiphallus 9 mm.; of flagellum 10; of spermatheca duct 15 mm.

The other forms examined have the flagellum very long, dart sack well developed, one of the mucus glands descending, spread upon the base of vagina, the other upon the dart sack, both bound down. Diverticulum developed and long except in *Stearnsiana*. In all, the spermatheca arises high, near the distal end of the vagina. The dimensions of the parts are as follows:

	<i>Pandoræ. Veitchii. Areolata. Stearnsiana.</i>				
Length of penis+epiphallus	15	35	28	22	28 mm.
Length of flagellum	21	67	50	26	27 mm.
Length of spermatheca duct	17½	54	49	43	35 mm.
Length of diverticulum	13	43	25	0	1 mm.

Thrown into the form of an analytical key, the genital characters give these results:

- a. Right eye retractor passing between ♂ and ♀ branches of genitalia; diverticulum presents one mucus gland spread upon and firmly bound to vagina below dart sack.
 - b. Flagellum and spermatheca duct of about equal length,
 - areolata.*
 - bb. Flagellum longer than spermatheca duct; diverticulum $\frac{3}{4}$ to $\frac{1}{2}$ length of spermatheca duct, much longer than the other branch.
 - c. Penis+epiphallus $\frac{3}{4}$ length of flagellum . . . *Pandoræ.*
 - cc. Penis+epiphallus about $\frac{1}{2}$ length of flagellum . *Veitchii.*
 - bbb. Flagellum shorter than spermatheca duct; diverticulum very short or wanting *Stearnsiana.*
- aa. Right eye retractor not passing between branches of genitalia; mucus glands free; no diverticulum; flagellum about the same length as penis+epiphallus.
 - b. Dart sack degenerate, very small *Guadalupiana.*

No further details of the genitalia are needed except such as are clearly shown in the figures; and of course some variation in the absolute dimensions of various organs is to be expected.

Details are lacking to intercalate the other species of the subgenus in the above synopsis, but from Binney's figures it seems that *E. Kelletti* and *Tryoni* fall into § *bb.* of the first division (*a.*) of this dichotomous table, and it is likely that *E. ruficincta* and *facta* group in the second division, *aa.* They differ from *E. Guadalupeana* Dall in having the dart sack well developed. The position of the eye retractor muscle is unknown. Neither of them has a diverticulum on the spermatheca duct.

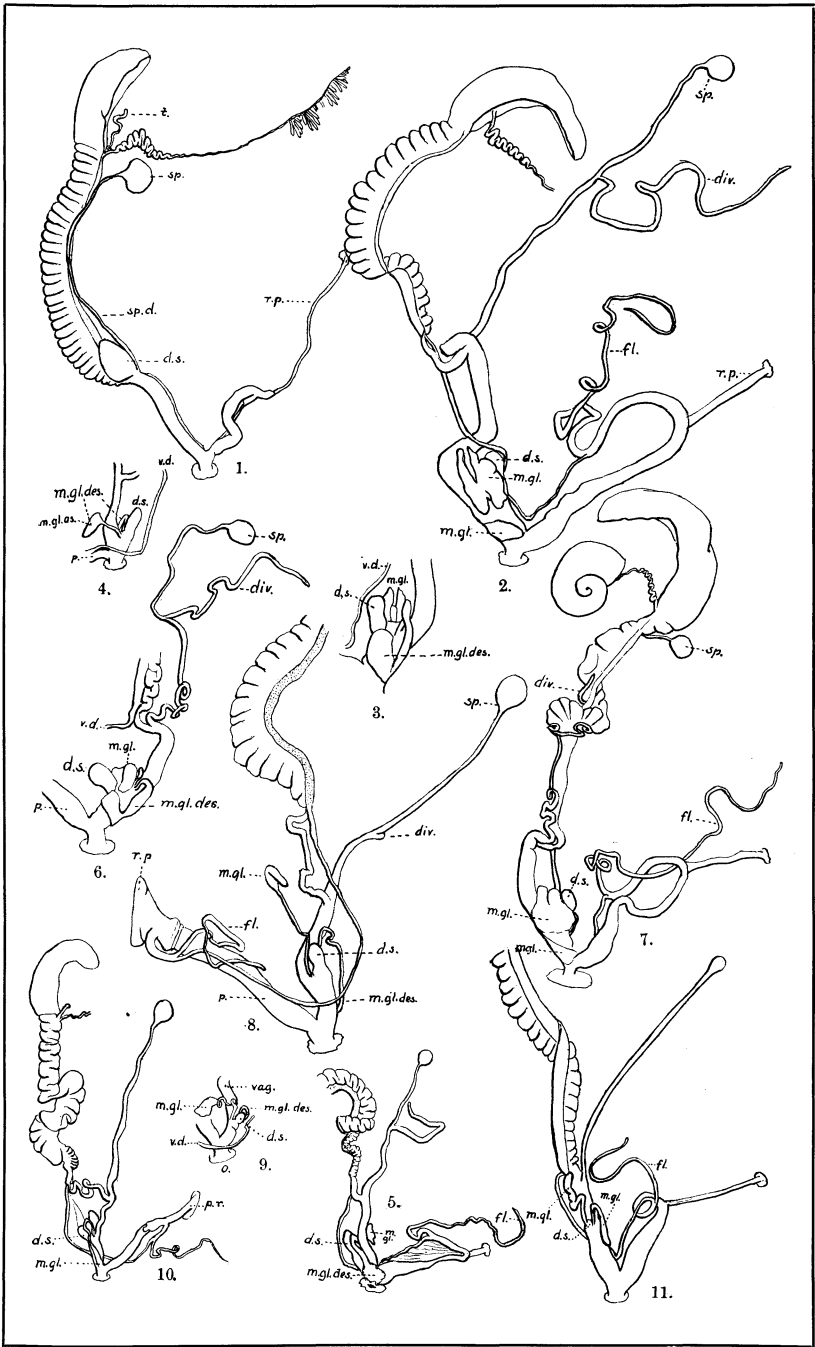
E. Stearnsiana differs considerably from *areolata*, *Pandora*, *Veitchii* and, according to Binney's figures, *Kelletti*, in having the diverticulum short or obsolete. Two specimens were dissected, both from Colorado Islands. In one (66,091 A. N. S. P. Mus., coll. by A. W. Anthony) there is no trace of a diverticulum. In the other (69,014, from Prof. W. H. Dall) there is a very short diverticulum, about 1 mm. long, arising slightly beyond the lower fourth of the length of spermatheca duct. In this specimen the duct is 8 mm. shorter than in the other. Binney's figure shows a somewhat longer diverticulum than our No. 69,014, but it is still very short. This variation in the diverticulum is exactly paralleled in the European *Helix pomatia*.

EXPLANATION OF PLATE I.

NOTE.—The shells of the specimens furnishing the genitalia figured, as well as the dissections, may be found in the collection of the Academy bearing numbers corresponding to those given below.

- (*Div.*, diverticulum of the spermatheca duct. *d. s.*, dart sack. *fl.*, flagellum. *m. gl. as.*, ascending mucous gland. *m. gl. des.*, descending ditto. *p.*, penis. *r. p.*, penis retractor muscle. *sp.*, spermatheca. *sp. d.*, duct of the spermatheca. *t.*, talon. *vag.*, vagina).
- Fig. 1. *Glyptostoma Newberryanum* (W. G. B.). Pasadena, Cal. No. 68,997.
- Fig. 2. *Epiphragmophora Veitchii* (Newc.). Cerros Is., of Lower Cal. No. 69,647.
- Fig. 3. The same individual, other side of the dart sac and adjacent organs.
- Fig. 4, 5. *Epiphragmophora Pandora Bonitosensis* Pils. Las Bonitos Is., off Lower California. No. 66,092.

- Fig. 6, 7. *Epiphragmophora areolata* (Sowb.). Natividad Is. No. 69,646. In fig. 6 the opposite side of dart sack and associated organs is seen, and the spermatheca duct with its diverticulum torn free from the uterus.
- Fig. 8. *Epiphragmophora Stearnsiana* (Gabb). Coronado Is. No. 69,014.
- Fig. 9, 10. Another specimen from the same locality, No. 66,091, showing no trace of the diverticulum upon spermatheca duct.
- Fig. 11. *Epiphragmophora Guadalupiana* Dall. Guadalupe I., off Lower Cal. No. 69,648 (Drawn to double the scale of other figures of this plate).



PILSBRY AND VANATTA. ANATOMY OF HELICIDÆ.